

The Science of 'Inside Out'

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By DACHER KELTNER and PAUL EKMAN

FIVE years ago, the writer and director Pete Docter of Pixar reached out to us to talk over an idea for a film, one that would portray how emotions work inside a person's head and at the same time shape a person's outer life with other people. He wanted to do this all in the mind of an 11-year-old girl as she navigated a few difficult days in her life.

As scientists who have studied emotion for decades, we were delighted to be asked. We ended up serving as scientific consultants for the movie, "Inside Out," which was recently released.

Our conversations with Mr. Docter and his team were generally about the science related to questions at the heart of the film: How do emotions govern the stream of consciousness? How do emotions color our memories of the past? What is the emotional life of an 11-year-old girl like? (Studies find that the experience of positive emotions begins to drop precipitously in frequency and intensity at that age.)

"Inside Out" is about how five emotions — personified as the characters Anger, Disgust, Fear, Sadness and Joy — grapple for control of the mind of an 11-year-old girl named Riley during the tumult of a move from Minnesota to San Francisco. (One of us suggested that the film include the full array of emotions now studied in science, but Mr. Docter rejected this idea for the simple reason that the story could handle only five or six characters.)

Riley's personality is principally defined by Joy, and this is fitting with what we know scientifically. Studies find that our identities are defined by specific emotions, which shape how we perceive the world, how we express ourselves and the responses we evoke in others.

But the real star of the film is Sadness, for "Inside Out" is a film about loss and what people gain when guided by feelings of sadness. Riley loses friends and her home in her move from Minnesota. Even more poignantly, she has entered the preteen years, which entails a loss of childhood.

We do have some quibbles with the portrayal of sadness in "Inside Out." Sadness is seen as a drag, a sluggish character that Joy literally has to drag around through Riley's mind. In fact, studies find that sadness is associated with elevated physiological arousal, activating the body to respond to loss. And in the film, Sadness is frumpy and off-putting. More often in real life, one person's sadness pulls other people in to comfort and help.

First, emotions organize — rather than disrupt — rational thinking. Traditionally, in the history of Western thought, the prevailing view has been that emotions are enemies of rationality and disruptive of cooperative social relations.

But the truth is that emotions guide our perceptions of the world, our memories of the past and even our moral judgments of right and wrong, most typically in ways that enable effective responses to the current situation. For example, studies find that when we are angry we are acutely attuned to what is unfair, which helps animate actions that remedy injustice.

We see this in “Inside Out.” Sadness gradually takes control of Riley’s thought processes about the changes she is going through. This is most evident when Sadness adds blue hues to the images of Riley’s memories of her life in Minnesota. Scientific studies find that our current emotions shape what we remember of the past. This is a vital function of Sadness in the film: It guides Riley to recognize the changes she is going through and what she has lost, which sets the stage for her to develop new facets of her identity.

Second, emotions organize — rather than disrupt — our social lives. Studies have found, for example, that emotions structure (not just color) such disparate social interactions as attachment between parents and children, sibling conflicts, flirtations between young courtiers and negotiations between rivals.

Other studies find that it is anger (more so than a sense of political identity) that moves social collectives to protest and remedy injustice. Research that one of us has conducted has found that expressions of embarrassment trigger others to forgive when we’ve acted in ways that momentarily violate social norms.

This insight, too, is dramatized in the movie. You might be inclined to think of sadness as a state defined by inaction and passivity — the absence of any purposeful action. But in “Inside Out,” as in real life, sadness prompts people to unite in response to loss. We see this first in an angry outburst at the dinner table that causes Riley to storm upstairs to lie alone in a dark room, leaving her dad to wonder what to do.

And toward the end of the film, it is Sadness that leads Riley to reunite with her parents, involving forms of touch and emotional sounds called “vocal bursts” — which one of us has studied in the lab — that convey the profound delights of reunion.

“Inside Out” offers a new approach to sadness. Its central insight: Embrace sadness, let it unfold, engage patiently with a preteen’s emotional struggles. Sadness will clarify what has been lost (childhood) and move the family toward what is to be gained: the foundations of new identities, for children and parents alike.

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Why Do We Experience Awe?

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By PAUL PIFF and DACHER KELTNER

HERE'S a curious fact about goose bumps. In many nonhuman mammals, goose bumps — that physiological reaction in which the muscles surrounding hair follicles contract — occur when individuals, along with other members of their species, face a threat. We humans, by contrast, can get goose bumps when we experience awe, that often-positive feeling of being in the presence of something vast that transcends our understanding of the world.

Why do humans experience awe? Years ago, one of us, Professor Keltner, argued (along with the psychologist Jonathan Haidt) that awe is the ultimate “collective” emotion, for it motivates people to do things that enhance the greater good. Through many activities that give us goose bumps — collective rituals, celebration, music and dance, religious gatherings and worship — awe might help shift our focus from our narrow self-interest to the interests of the group to which we belong.

Now, recent research of ours, to be published in next month's issue of the *Journal of Personality and Social Psychology*, provides strong empirical support for this claim. We found that awe helps bind us to others, motivating us to act in collaborative ways that enable strong groups and cohesive communities.

For example, in one study we asked more than 1,500 individuals across the United States a series of questions to assess how much awe, among other emotions, they experienced on a regular basis. In an ostensibly unrelated part of the study, we gave each person 10 lottery tickets that would be entered in his (or her) name for a cash prize drawing. We told each person that the tickets were his to keep, but that if he wanted to, he could share a portion of them with another unidentified individual in the study who had not received any tickets.

We found that participants who reported experiencing more awe in their lives, who felt more regular wonder and beauty in the world around them, were more generous to the stranger. They gave approximately 40 percent more of their tickets away than did participants who were awe-deprived.

Some of this research was conducted on the campus of the University of California, Berkeley, which has a spectacular grove of Tasmanian blue gum eucalyptus trees, some with heights exceeding 200 feet — a potent source of everyday awe for anyone who walks by. So we took participants there and had them either look up into the trees or look at the facade of a nearby science building, for one minute. Then, a minor “accident” occurred (actually a planned part of the experiment): A person stumbled and dropped a handful of pens. Participants who had spent the minute looking up at the tall trees — not long, but long enough, we found, to be filled with awe — picked up more pens to help the other person.

In other experiments, we evoked feelings of awe in the lab, for example by having participants recall and write about a past experience of awe or watch a five-minute

video of sublime scenes of nature. Participants experiencing awe, more so than those participants experiencing emotions like pride or amusement, cooperated more, shared more resources and sacrificed more for others — all of which are behaviors necessary for our collective life.

In still other studies, we have sought to understand why awe arouses altruism of different kinds. One answer is that awe imbues people with a different sense of themselves, one that is smaller, more humble and part of something larger. Our research finds that even brief experiences of awe, such as being amid beautiful tall trees, lead people to feel less narcissistic and entitled and more attuned to the common humanity people share with one another. In the great balancing act of our social lives, between the gratification of self-interest and a concern for others, fleeting experiences of awe redefine the self in terms of the collective, and orient our actions toward the needs of those around us.

You could make the case that our culture today is awe-deprived. Adults spend more and more time working and commuting and less time outdoors and with other people. Camping trips, picnics and midnight skies are forgone in favor of working weekends and late at night. Attendance at arts events — live music, theater, museums and galleries — has dropped over the years. This goes for children, too: Arts and music programs in schools are being dismantled in lieu of programs better suited to standardized testing; time outdoors and for novel, unbounded exploration are sacrificed for résumé-building activities.

We believe that awe deprivation has had a hand in a broad societal shift that has been widely observed over the past 50 years: People have become more individualistic, more self-focused, more materialistic and less connected to others. To reverse this trend, we suggest that people insist on experiencing more everyday awe, to actively seek out what gives them goose bumps, be it in looking at trees, night skies, patterns of wind on water or the quotidian nobility of others — the teenage punk who gives up his seat on public transportation, the young child who explores the world in a state of wonder, the person who presses on against all odds.

All of us will be better off for it.

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